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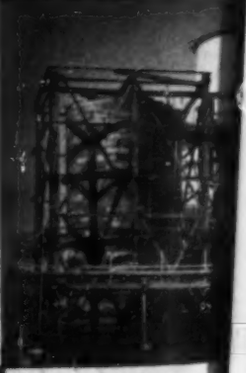

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# Feature Section

## Research in Industry[1]

*George W. Heise*[2]

I wish I had the eloquence adequately to express my appreciation and gratitude for the great honor that has been conferred on me—to the Society to which I already owe so much, and to the Acheson family which has made possible, and maintained its support of, the Award. However, I cannot but feel that my principal indebtedness is due the group of loyal coworkers whose organized effort, not any individual accomplishment on my part, affords the only legitimate basis for the citation. It is of the impact of this and similar groups on the philosophy and accomplishments of industrial research that I should like to speak briefly.

I believe that I have enjoyed in fullest measure one of the greatest privileges offered in industrial work: the association with a group of technical men, dedicated to their profession, who chose to make research a career rather than a stepping stone to material success. That choice is not always an easy one for it is the exceptional rather than the average organization which permits the research man to achieve a satisfying career, on terms of parity with the executive or administrator; and all too frequently it is the latter who dictates the direction of research as well as its policy. Little wonder, then, that we lose the productive capacity of a distressingly large number of our promising technical men who abandon active research for more lucrative fields.

If we add to the foregoing the absorption of even greater numbers of potential research men by sales and sales engineering, development, and production, the problem of maintenance of an adequate supply of competent research workers becomes a serious one. The situation is further aggravated by our apparent failure to attract a sufficient number of students to careers in the physical sciences. Even now our numerical superiority in engineers and scientists, so vital to our national future, is being challenged by another country which, indeed, is already reported to have a rate of production of qualified technical personnel in excess of our own.[3]

Nor, it seems to me, are we using our available technical manpower to best advantage. There is great overlapping of activity, much of it not readily avoidable under a system of free enterprise. A great deal of "sponsored" research, ostensibly undertaken to aid industry, is frankly competitive with, rather than complementary to the work of established industrial laboratories.

Another factor militating against the success of our industrial program and the realization of a satisfying career in research is the undue emphasis so frequently placed on near-term, practical objectives. It may be of interest to note that almost 125 years ago de Tocqueville[4] commented on this trait as characteristic of a democracy such as that of America. Said he:

> "... the more democratic, enlightened, and free a nation is, the greater will be the number of ... interested promoters of scientific genius and the more discoveries immediately applicable to productive industry confer on their authors gain, fame, and even power. ...
>
> "In a community thus organized, it may easily be conceived that the human mind may be led insensibly to the neglect of theory; and that it is urged, on the contrary, with unparalleled energy, to the application of science, or at least to that portion of theoretical science which is necessary to those who make such applications. ...
>
> "In the present age the human mind must be coerced into theoretical studies; it runs of its own accord to practical applications; and, instead of perpetually referring it to the minute examination of secondary effects, it is well to divert it from them sometimes, in order to raise it up to the contemplation of primary causes."

I hasten to add that I am fully aware that the technological advances due to industrial research have been many and important, and that the steady increase in the number of competent research organizations offers ample assurance of continued progress. Further, the chemical industry, at least in recent years, has not been niggardly in its financial support, some of the more progressive corporations allocating from 3 to 5% of their sales income to "research" so-called. Yet there is admittedly a serious imbalance between fundamental and applied investigation,[5] as much as 94% of available funds, it has been estimated, going to the latter. The "criterion of immediate usefulness," long considered a sterilizing influence in American education, can have even more devastating and stultifying effect on industrial research.

In many quarters it is held that pure research should be left to the universities and nonprofit institutions;[6] indeed, in the words of one prominent industrialist, "only in the academic environment can fundamental research in its true sense flourish." Surely this is an over-simplification which, at the very least, must have a depressing effect on the young scientist, anxious to carve out a career in research in an industrial laboratory. For my part, I doubt that a research organization can operate at full efficiency over a long period of years unless it is willing and able to carry on its share of basic studies with its own personnel.

[1] Edward Goodrich Acheson Medal Address delivered at the Boston Meeting, October 5, 1954.

[2] Consultant, Cleveland, Ohio. Prior to his retirement in June, 1953, Mr. Heise was associated with the Research Laboratories National Carbon Company, Cleveland, as department head in charge of research on primary cells and electrolytic processes.

[3] H. C. Kelly, Editorial in *Science*, July 2, 1954.

[4] A. de Tocqueville, "Democracy in America," ca. 1833; translation reprinted by Alfred A. Knopf, New York (1945).

[5] Cf., *inter alia*, Editorial in *Chemistry & Industry*, No. 6, Feb. 6, 1954.

[6] Cf. G. Piel in *Saturday Review of Literature*, Reader No. 3 (1954).

Industrial research, to be sure, must pay its own way or, as a previous medalist[7] expressed it, should be capable of furnishing its own endowment. Therefore, I find it quite proper that its success should be measured in terms of the number and importance of its pragmatic accomplishments. However, the search for fundamental knowledge, undertaken to satisfy intellectual curiosity, can demonstrably lead to larger material rewards, as well as greater scientific advance, than an investigation with objectives too rigidly fixed, in which wishful thinking and the desire for quick returns dictate the direction of technical effort. All too frequently, the attempt to *define* concrete commercial goals literally *limits* the results obtained and, at the very least, hampers the "spirit of free inquiry" essential to scientific research and intellectual growth. The practical achievements are the by-products —largely unforeseeable—of a properly organized research program which, in addition to offering greater financial rewards, simultaneously opens up more new avenues for further profitable investigation than the same effort expended on isolated projects.

Thus, even the most limited of investigations can become part of a drive toward a goal far beyond the immediate, near-term objective. Since the larger program is usually too broad in scope for a single person, it, in turn, offers a means for integrating the efforts of several workers, without in the least restricting their initiative or depriving them of credit for individual accomplishment, and broadening rather than limiting their areas of interest. The value of the individual is then dependent on his contribution to group effort, whether on long-range or immediate, practical problems, whereas the success of the group can still be measured in terms of material progress. Thus, long-term investigations can be protected, to some extent at least, from overly materialistic appraisal, and a more favorable balance between pure and applied research can be secured.

I would like to believe that, in the case of our own electrochemical studies, the fuel cell offered the type of remote objective I have just mentioned. It guided our efforts in a manner to increase our practical accomplishment, the latter in turn, furnishing justification and added incentive for continued research on the broader problem. Nor need an electrochemist apologize for giving this direction to his efforts, for the direct conversion of chemical into electrical energy has long been a tantalizing objective. Even the humble flashlight cell can produce current at an efficiency of about 65%, some two or three times that obtained from conventional fuel-combustion and motor-generator systems; even greater efficiencies are quite possible. If similar high utilization could be obtained, under conditions of continuous operation, in voltaic cells in which ordinary fuels—carbon, hydrogen, carbon monoxide, and the like—were substituted for metals commonly used as anodes, and in which atmospheric oxygen served as cathodic depolarizer, an important advance in power production might be realized. The combustion of 1 kg of carbon in a fuel cell, by way of example, is theoretically capable of yielding up to 10 kwhr of electrical energy, approximately five times the present practical limit (2 kwhr) realized from a conventional heat-engine dynamo system.

Nor is the fuel cell lacking in historic interest; indeed, even the list of workers in this field is an imposing one, including, among others, such outstanding names as Davy, Becquerel, Grove, Tomassi, Ostwald, Coehn, Haber, Nernst, Baur, and Foerster.

In 1801, only a year after Volta's announcement of the original primary battery, Pepys[8] found that oxygen was absorbed when a Volta Pile was operated in air, and that current tended to diminish as nitrogen concentration increased. As early as 1802, Davy used carbon as anode in a galvanic cell,[9] with nitric acid serving as both electrolyte and cathodic depolarizer. However, the first true fuel cell was probably that of Grove who, in 1839, described a cell[10] with two plain platinum electrodes, as follows:

> "... over each piece of platinum was inverted a tube of gas, four-tenths of an inch in diameter, one of oxygen, the other of hydrogen, acidulated water reaching a certain mark on the glass, so that about half of the platina was exposed to the gas, and half to the water. The instant the tubes were lowered so as to expose part of the surfaces of platinum to the gases, the galvanometer needle was deflected so strongly as to turn more than half round. ...
>
> "... After 24 hours, the water had risen half an inch in the tube containing hydrogen, and three eighths of an inch in that containing oxygen."

In the same paper appears the significant and prophetic statement: "I hope, by repeating this experiment in series, to effect decomposition of water by means of its composition."

So, in 1842, Grove constructed a battery of 50 cells, this time with platinized platinum electrodes, in which, to quote his own words:[11]

> "The tubes were not all of equal size, nor were they graduated; the exact proportional diminution of gas in each tube could not be ascertained with perfect accuracy; both gases did diminish, and the hydrogen so much more rapidly than the oxygen that my assistant, who was unacquainted with the rationale of the battery, observed that hydrogen was absorbed twice as fast as the oxygen."

With this battery Grove made good his prediction. Only four cells in series were required to decompose potassium iodide but "twenty-six pairs were the smallest number which would decompose water." He wrote further:

> "This battery establishes that gases in combining and acquiring a liquid form evolve a sufficient force to decompose a similar liquid and cause it to acquire a gaseous form. This is to my mind the most interesting effect of the battery; it exhibits such a beautiful instance of the correlation of natural forces."

Surely on the basis of such statements, and their dates, we may well claim for the electrochemist (and jurist) Sir William Robert Grove admission to that galaxy—the engineers Carnot and Colding, the physician J. R. Mayer, the physiologist Helmholtz, and the industrialist Joule, to which the evolution of the doctrine of the conservation of energy is generally attributed.

As is only fitting in research activity, the early work was done for the extension of knowledge rather than directed toward immediately practical objectives; despite some intermediate work, it was not until the 1880's and 1890's that the attempt to utilize fuel cells for power production attained any great impetus. Cell systems with molten salt electrolyte for high temperature operation as well as those with aqueous

[7] C. F. Burgess. cf O. W. Storey, *Chem. Eng. News*, **18**, 999 (1940).

[8] Through Viard, *Phil. Mag.*, [4], **6**, 241 (1853).

[9] *Nicholson's J.*, p. 144 (1802).

[10] *Phil Mag.*, [3], **14**, 129 (1839).

[11] *Ibid.*, [3] **21**, 417 (1842).

electrolyte for work at ordinary temperatures have been investigated.

Efforts to use carbon directly met with indifferent success; indirect methods have fared somewhat better. For example, the "water-gas" reaction between carbon, or methane, and steam at high temperature yields hydrogen and carbon monoxide, both capable of electrochemical utilization. For cells with these anodic fuels operating in molten electrolyte (700°C) against cathodes depolarized atmospheric oxygen, (free) energy efficiencies as high as 90% have been claimed. Yet voltages (theoretically, about one volt per cell) and current densities are still too low for sound commercial practice. Excellent results have been realized with hydrogen-oxygen cells operating at elevated temperatures and high pressures, but in this case the gaseous components are too costly for a competitive system of power production. Possibly our own development of an oxygen electrode capable of operating in aqueous electrolyte at well above 300 amp/ft$^2$—perhaps 100 times the current density realized from conventional dry batteries—may yet prove a modest contribution toward the success of the "continuous feed" battery.

Thus the fuel cell engaged the attention of electrochemists long before our time, and others have advanced its development much farther than we have been able to carry it ourselves. Its economics are confused, to say the least, and it may never become competitive with orthodox methods of power production. Yet in our own laboratories, it was the research directed toward this long-range goal that pointed the way toward the more practical objectives which gave promise of being of practical value: gas electrodes (hydrogen, sulfur dioxide, chlorine, oxygen) operable in aqueous electrolyte; the air-depolarized battery of commerce; porous electrodes with liquid depolarizers; and a number of advances in the theory and technology of convent onal battery systems. In many instances, the pragmatic result would not have been achieved as expeditiously, if at all, by direct attack.

In articles on industrial research, as in other fields, great emphasis is frequently placed on "inspired leadership." Presumably, such leadership exists, although I doubt that the success of a research group is dependent to any major extent on its leader's ability to serve as a fountain head of ideas or as dexterous manipulator of the technical activities of subordinates. In my opinion, this type of direction is not to be compared in effectiveness with the intelligent, coordinated effort of a group of dedicated professional men, working independently as intellectual peers, on allied projects in a broad field of common interest. To my former associates in the laboratory, who made a relationship of this type possible, my deep appreciation and humble thanks.

# Current Affairs

## Highlights of the Meeting of the Board of Directors

*(Held October 3, 1954, Statler Hotel, Boston, Mass.)*

The Secretary reported that the financial operations of the Society are staying pretty well within the budget, both income and expenditures.

It was announced that Mr. George W. Heise, current Acheson Medalist, was, at the time of the Boston Meeting, in the process of transferring 12 shares of Union Carbide and Carbon Corporation stock to The Electrochemical Society (this transfer was consummated October 6—price of record on that date $83 per share). The President expressed the gratitude of the Society for this very generous gesture.

The Secretary announced that 732 affirmative votes had been received on the revision of the Constitution against 6 negative votes. This was considered by the Board to finish the voting on the Constitution, and therefore the Society is operating under the new Constitution.

The Prize Essay Contest winners were announced as follows:

*First Prize*—Ralph J. Brodd, 2709 Hemphill Park, Austin, Texas

*Second Prize*—A. C. Makrides, University of Texas, Chemistry Dept., Austin, Texas

*Honorable Mention*—Francis van Hecke, 183 Avenue de Tervueren, Brussels, Belgium; and William E. Tragert, Research Laboratory, General Electric Co., Schenectady, N. Y.

The President asked for and received authority from the Board to appoint Mr. George W. Heise and Dr. Charles L. Faust as members of the Acheson Award Committee, to be effective in November 1954.

The Palladium Medal Committee announced that the next Palladium Medalist will be Dr. U. R. Evans of Cambridge, England. Dr. Uhlig requested the Board to approve this selection, which was done.

The Membership Committee reported, indicating very great activity in that Committee.

Dr. R. M. Burns presented a fairly complete summary of the situation with respect to publications.

The Ways and Means Committee reported on several items that they had been studying. They recommended that the Board go on record as not favoring indiscriminate photographing of slides during technical sessions. The program booklet will carry announcements to this effect, and the chairmen of technical sessions will administer the rule.

The results of the Ways and Means Committee's study of financing of conventions was presented. They recommended an interim action, raising the head tax from $2 to $3 for registrants. This was approved. The Ways and Means Committee and Council of Local Sections are currently studying the problem.

The propriety of using a reader's service card in the JOURNAL was discussed and approved. The Ways and Means Committee further recommended that the program booklet be considered as an advertising medium in the future. It was felt that possibly local groups could pick up local advertising, such as restaurants, shows, etc.

The problem of publicity was then discussed at some length, with the recommendation that the editorial staff of the JOURNAL go a little bit further in their publicity releases, using a covering letter containing a proposed summary of each symposia. This summary should be prepared by the symposia chairmen.

The Ways and Means Committee further recommended that alternate hotels be listed in the program booklet wherever possible.

The proposition to take over the publication of the Semiconductor bibliography was discussed, and the Publications Committee was authorized to investigate this proposition and given power to act on any conclusions that they reach as a result of this study.

The meeting was adjourned at 4:50 P.M.

HENRY B. LINFORD, *Secretary*

## NEWS ITEMS

### 75th Anniversary of Edison's Incandescent Lamp

October 21, 1954, marked the 75th anniversary of Thomas A. Edison's invention of the first practical incandescent lamp.

Since that time 39,500,000,000 electric lamps have been produced in this country to fill the nation's lighting needs. As many more will be produced in the next 15 years.

Lighting is of ever-increasing importance to all phases of this modern civilization of ours. Indeed, the electric lamp touches the lives of more people more often in more different ways than any other product, except possibly clothing.

Until 75 years ago there were only open-flame light sources—the torch, the candle, the oil lamp, the gas mantle. All of them played important parts in the cultural and social advance of man through the centuries.

It was not until 1879, when science produced electric light, that light was created without flame. Edison's invention of the first practical incandescent lamp, just three-quarters of a century ago, marked the beginning of the age of electric light, the beginning of convenience, safety, dependability, and comfort in lighting.

The possibility of an illuminant using

electricity had been demonstrated with crude, short-lived "lamps" in laboratories before Edison's birth. But to Edison goes the credit for inventing the first commercially practical incandescent lamp. He made over 1200 experiments on lamps at his research laboratory in Menlo Park, N. J., beginning in 1877. The technical details of his final results are known to readers of the JOURNAL.

Today, thousands of sizes and types of incandescent lamps are marketed, many tailor-made for specific lighting jobs. In 1954, an estimated one and one-half billion incandescent lamps are the industry's total production in the United States. These include both large and miniature sizes, and Christmas lamp types. The lamp of today resulted from the researches of such men as Whitney, Coolidge, Langmuir, all of G.E.

In the same year that Edison lighted the first practical incandescent lamp (1879), Charles F. Brush made the first installation of public lighting with arc lamps in the United States. The downtown area of the city of Cleveland was lighted by 12 lamps mounted on high towers.

In 1860 Professor John Thomas Way discovered that if an electric circuit were opened between two jets of mercury, a brilliant greenish arc was produced. The next 40 years brought many types of arc lamps, largely experimental ones.

The fluorescent lamp, in effect, is a low-pressure mercury lamp with a phosphor on the inside of the tube. Synthetic phosphors were developed to utilize the ultraviolet energy which the low-pressure mercury arc discharge produces in relatively large quantities. The phosphor converts the invisible ultraviolet energy into visible light, the color of which depends upon the composition of the phosphor.

The most important function of lamps is to generate light, and the 75-year development history of electric lamps has been concentrated largely on producing light more efficiently. Illuminating engineers define light as "visually evaluated radiant energy." Light sources radiate energy of varying wavelengths. Just as a radio receiver may be tuned to different wavelength bands, the human eye is a "receiver" for wavelengths between 3800 and 7600 Å.

In addition to the visible part of the spectrum, light sources also radiate energy of wavelengths shorter than visible and larger than visible. These, respectively, are ultraviolet radiation and infrared radiation.

Approximately a half-billion photoflash bulbs will have been used by picture takers, both amateur and professional, in 1954. This is about 50 million more than were used the year before. Flash photography probably is America's fastest growing hobby. Approximately 15 million cameras owned in the United States are equipped for flash picture taking. It is estimated that about 25% of all pictures taken are with flash, and experts see 45% as a realistic goal for the foreseeable future.

Photoflash lamps were introduced commercially in this country in 1930. Their first impact was in the form of revolutionizing the art of pictorial news reporting, and in broadening the range of professional photography. The "midget" flashbulb, introduced by G. E. in 1939, gave great impetus to the use of this light source in the amateur field.

Electroluminescence is a relatively new method of producing light by the direct conversion of electric energy within a semiconducting solid. It is a fundamentally attractive method of creating light, because it is not inherently limited in efficiency. Both incandescent and fluorescent lamps are limited in ultimate efficiency by the indirect means used to convert the electric energy into light.

## P. Delahay to Receive ACS Award

The 1955 Award in Pure Chemistry of the American Chemical Society will be given to Dr. Paul Delahay of Louisiana State University, Baton Rouge. The announcement was made at the National Meeting of the American Chemical Society in New York on September 13. This annual award is presented to a chemist under 36 who has made a most significant contribution to chemistry in North America. Dr. Delahay was selected for his work on the development of new electrochemical methods and their applications to physical and analytical chemistry. This is the first time that the award will be made for work in the field of electrode processes.

Dr. Delahay was born in the Netherlands on April 6, 1921, and received his education in Belgium and the United States, coming to this country in 1946. In 1949 he joined the Louisiana State University, where he is currently associate professor of chemistry. Previously, he had been at the University of Oregon. He holds M.S. degrees in electrical engineering and chemistry, and a Ph.D. degree in chemistry.

PAUL DELAHAY

His main research interest has been in electrochemical kinetics and thermodynamics, and he has contributed extensively to the theoretical analysis of electrode processes. He has taken part in numerous symposia and meetings in this country and Western Europe and is the author of a recent monograph on new electrochemical methods.

Active in Electrochemical Society affairs, Dr. Delahay at present is serving as Vice-Chairman of the Theoretical Electrochemistry Division.

## 6th Annual Dinner of the Chemical Profession in Cleveland

Ivor Griffith, a distinguished pharmaceutical chemist and President of The Philadelphia College of Pharmacy, gave the program lecture at the Sixth Annual Dinner of the Chemical Profession in Cleveland on Wednesday, November 3. Dr. Griffith, who has made extensive scientific studies in Gerontology and Geriatrics considered some aspects of this field in his address, "Live Longer and Like It."

In addition to his pioneering accomplishments in the fields of research, education, and as editor of scientific journals, Dr. Griffith is recognized widely for his skill as an author and lecturer in interpreting science accurately to popular as well as scientific audiences.

The dinner meeting was jointly sponsored by the local sections of The American Chemical Society, The Electrochemical Society, Alpha Chi Sigma, The American Institute of Chemical Engineers, and The American Institute of Chemists. This joint so-

ciety dinner, now an annual tradition, is one of the means of promoting liaison between different societies with respect to common interests concerned with the professional status and civic responsibilities of chemists in Cleveland.

## Pipe-Type Cable Corrosion Protection Report Available

"Pipe-Type Cable Corrosion Protection Practices in the Utilities Industry," the First Interim Report of Technical Unit Committee T-4B on Corrosion of Cable Sheaths has been published by the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Texas. Copies of the 15-page report are available at 50¢ postpaid if remittance accompanies the order. The report has been designated NACE Publication 54-3. It was compiled by Task Group T-4B-4 on Protection of Pipe Type Cables under its chairman Frank Kahn, Philadelphia Electric Company, Philadelphia, Pa.

Reports of the practices of 17 utilities operating 294 miles of high pressure oil and gas filled power cables are consolidated and tabulated. The reports are estimated to cover more than 90% of this type of power cable operated in the United States. Information included in the report consists of physical characteristics of the pipe, types of coating, how holidays are detected, how coating resistance measurements are made, grounding provisions, stray current requirements and cathodic protection.

## Technique for Quality Control of Titanium

Hydrogen content of titanium metal and alloys can be determined quickly and accurately by a new technique recently developed by National Research Corporation, Cambridge, Mass. Employing the NRC Model 912 vacuum fusion gas analysis apparatus, this technique enables hydrogen content to be determined in less than 20 minutes. Accuracy is better than plus or minus 4%. This is of importance because recent work has established that small concentrations of hydrogen in titanium metals and alloys may have critical and adverse effects on their physical properties. This new technique for the rapid analysis of hydrogen content can be used to eliminate costly work on defective titanium or titanium alloys.

National Research Corporation, a pioneer in vacuum metallurgy, offers the Model 912 through its equipment sales subsidiary, Naresco Equipment Corporation, 160 Charlemont St., Newton Highlands 61, Mass. The services of its analytical department are also available on a nominal service basis.

## Versatile Nickel Plating Process

An improved nickel sulfamate plating process, developed by Hanson-Van Winkle-Munning Company, Matawan, N. J., (*a*) plates 75% faster, (*b*) is more versatile, (*c*) is easier to control, and (*d*) produces harder deposits with less brittleness than other sulfamate processes presently available. The new bath plates up to 0.007 in. of nickel per hour compared to a high of 0.004 in. per hour possible with present baths. Operation at current densities of 140 asf makes this high speed possible—conventional baths go only as high as 80 asf.

With this versatile process, deposits of low internal stress are easily obtained, and a wide range of specific compressive and tensile stresses are also possible. Compressive stresses from zero to $-9 \times 10^3$ psi and tensile stresses from zero to $18 \times 10^3$ psi may be had by varying current density, temperature, and concentration of the bath's addition agent.

Stress characteristics obtained with these variables have been charted. Users of the process may obtain operating conditions for desired stress by reading them right off the chart.

The bath is made up of nickel sulfamate, nickel chloride, boric acid, and an addition agent. Pitting is no problem, and solutions do not require a wetting agent. Purity of the new bath consequently is higher, and complete analysis of all constituents is possible.

Commercially tested, the H-VW-M bath has been operating for several months in an electroforming installation and for ten months in an electrotyping foundry. As an example of the hardness obtainable without abnormal brittleness, electrotype plates at the printing installation prepared in the new bath have lasted 50% longer in smooth-stock printing and approximately 35% longer in carton printing than conventionally coated plates.

Like conventional baths, this bath has high conductivity and excellent anode corrosion. Anode and cathode efficiencies are in close balance, making for stable composition for long periods. The bath is not sensitive to impurities, either organic or metallic. If excessively contaminated it can be purified with activated carbon and low current density electrolysis.

Heating, filtering, and pumping equipment may be made of Karbate, nickel, or rubber, and lined with Koroseal or Saran. Stainless steel may be used in spots where the bare metal cannot become anodic.

For further information, write to Warren McMullen, Hanson-Van Winkle-Munning Company, Matawan, N. J.

## Lithium Corp. Opens N. Y. Sales Office

Lithium Corporation of America, Inc., has announced the opening of a sales office in New York City, located at 540 Lincoln Bldg., 60 East 42nd St., New York 7. J. Douglas Campbell is the representative in charge. The office has been opened to offer better service to customers in New York and vicinity.

## Knapp Mills to Use Plastics for Major Chemical Equipment

Alfred P. Knapp, President of Knapp Mills, Inc., of New York, world's largest producer of lead clad steel and lead clad copper, recently announced plans to diversify the company's operations by also producing large scale chemical and process equipment from rigid unplasticized polyvinyl chloride.

In announcing this decision to enter into the fabrication of plastics, Mr. Knapp said that last year the company had undertaken a foreign licensing program which resulted in the exchange of American patents and know-how for the latest developments in the chemical equipment field in Germany, France, and Italy. "Our survey indicated that European engineers had had great success in the production of massive and complicated chemical equipment from plastics, some of it in service as long as 15 years. Wherever permanently successful applications had been developed, it was observed that the material used was unplasticized polyvinyl chloride," Mr. Knapp said. He further stated that investigation revealed that the use of unplasticized polyvinyl chloride in American industries has had excellent results in many of the simpler applications of this versatile plastic.

After surveying the plastics field in this country to be assured of materials which will fully comply with or exceed the strictest European standards, and

to make certain that this material is produced without the aid of plasticizers which reduce the corrosion resistance of the finished equipment, Knapp Mills decided to use Boltaron 6200.

Negotiations have recently been concluded with H. N. Hartwell and Sons, Inc., international distributors of unplasticized P.V.C. known as Boltaron 6200, and a modified form known as Boltaron 7200 with exceptionally good resistance to impact.

### Diode Amplifier

Research on application of semiconducting diodes has led to the development of a new class of amplifiers that utilizes the reverse transient phenomenon of these two-element rectifying devices. Devised by A. W. Holt of the National Bureau of Standards, Washington, D. C., the diode amplifier—using no vacuum tubes and achieving power gains up to 10 per stage—promises important application in the future design of high-speed electronic digital computers. For example, it may be used as a pulse repeater stage, in varied types of flip-flop circuits, or as a wide-band, flat-response amplifier. Because suitable diodes are now in regular production, commercial applications are practical at the present time. Future improvement in the manufacture of diodes may make the principle useful for amplification at even microwave frequencies.

The basic requirement of the diode amplifier is that it be supplied with power from an r-f source whose frequency is the same or higher than the modulating signal frequency. This requirement puts the circuit in the same category as magnetic and dielectric amplifiers.

### Study on Aluminum Extrusions

A comprehensive study of aluminum extrusions, prepared by G. Roger Smith, head of the Technical and Development department of Harvey Aluminum, Torrance, Calif., has recently been published.

The purpose of the publication, as stated in the foreword, is twofold—"one, to point out the vast and inexhaustible uses to which the aluminum extrusion can be applied in new design; and secondly, to aid those now using the aluminum extrusion in improving existing designs."

Technical material covered in the 36-page text includes current applications, design advantages, fabricating, finishes, general characteristics, etc. Data-packed charts, illustrations, and sketches are used extensively throughout the book.

The study is available from Harvey Aluminum, 19200 S. Western Ave., Torrance, Calif., by request on business stationery. Additional copies are $1.50 each.

### Volumes Wanted

Society Headquarters needs copies of Vol. 62 (1932), 64 (1933), 65 and 66 (1934), 67 (1935), and 69 and 70 (1936) of the TRANSACTIONS.

Will anyone who has a copy he no longer needs please so inform the Managing Editor, Journal of The Electrochemical Society, 216 West 102 Street, New York 25, N. Y.

### Volumes Available

Anyone who wishes to secure any of the volumes of the TRANSACTIONS listed below should contact S. B. Doak, 1457 Maple Avenue, Shawinigan Falls, Quebec, Canada.

Vol. 45 and 46 (1924), 47 and 48 (1925), 49 and 50 (1926), 51 and 52 (1927), 53 and 54 (1928), 69 (1936), 72 (1937), 74 (1938), and 75 and 76 (1939).

## DIVISION NEWS

### Battery Division

The symposium on electrode reactions and battery technology, sponsored jointly by the Battery and Theoretical Divisions at the October Meeting of the Society in Boston, was very successful from every point of view. Each of the six technical sessions was well attended. Thirty-six papers were presented and many of them were followed by lively discussion from the floor. The subject matter of the papers was about evenly divided between the three subjects, theoretical papers applicable to all types of cells, and papers dealing with primary and secondary cell systems.

The Battery Division luncheon and biannual business meeting was held at noon on Tuesday, October 5, in the Bay State Room of the Hotel Statler, with about 120 members and guests present. The Division Chairman, E. Willihnganz, presided.

At the biannual election of officers the following were elected to serve for two years:

*Chairman*—N. C. Cahoon
*Vice-Chairman*—U. B. Thomas
*Secretary-Treasurer*—E. J. Ritchie
*Members-at-Large of the Executive Committee*—W. J. Hamer and J. J. Coleman

It was announced that George W. Heise had consented to serve as editor for a book on primary batteries to be sponsored by the Battery Division. Further consideration of an award in the field of battery technology will be taken up by a committee to be appointed by the Division Chairman.

The Secretary-Treasurer reported that the membership in the Division had dropped from 299 to 196 largely as the result of the assessment of dues and the resulting resignation of those who no longer have an immediate interest in battery science. The publication of extended abstracts and their advance delivery to the Division members proved to be a successful financial operation, as well as contributing much to the success of the meeting. At the time of the business meeting the treasury had a net balance of $315.01, with a considerable number of abstracts on hand which it is anticipated will be sold during the next year. It is planned to continue the publication of such abstracts for future meetings.

The retiring Chairman, E. Willihnganz, thanked the co-chairmen of the Joint Symposium, N. C. Cahoon and E. B. Yeager, for the large amount of time and effort they had spent to organize the symposium and handle the detail of editing the abstract bulletin. Thanks were also expressed to all who had contributed papers or other services to make the meeting a success. Dr. Willihnganz then turned the chair over to Dr. Cahoon who briefly expressed his appreciation for the cooperation given him in preparing the symposium and abstracts.

E. J. RITCHIE, *Secretary-Treasurer*

### Corrosion Division

The Corrosion Division held its annual meetings at the Fall Meeting of the Society in Boston. Three sessions were devoted to a Symposium on Stress Corrosion, and this was followed by three sessions of general papers. A one-session Symposium on high temperature oxidation of metals had to be cancelled because the speakers were unable to attend.

The annual business meeting was convened by the Chairman, W. D. Robertson, immediately after the Division luncheon on October 6. The Secretary-Treasurer, C. V. King, reported no income or expenditures from the treasury during the year, with a balance of $32.18 remaining (aside from Corrosion Handbook funds, which are administered separately). He reported that the Division Bylaws needed minor revision to conform to the practices of the Division and the changes were approved by the membership.

The nominating committee presented the following slate of candidates for office during the coming year:

*Chairman*—J. V. Petrocelli
*Vice-Chairman*—T. P. May
*Secretary-Treasurer*—C. V. King

The candidates were elected without dissent and were installed in office. The incoming Chairman, Dr. J. V. Petrocelli, spoke briefly of his plans for the coming year.

The outgoing Chairman, Dr. W. D. Robertson, urged the new Executive Committee to consider the delegation of more duties to the Vice-Chairman, particularly with respect to the organization of meeting programs, so that the Chairman could devote more time to other Division affairs and plans. It was suggested from the floor that this proposal be considered further, perhaps incorporated in the Bylaws at a future date.

C. V. KING, *Secretary-Treasurer*

## Electrodeposition Division

The annual luncheon and business meeting of the Electrodeposition Division was held on October 5 at the Boston Convention. Chairman M. L. Holt reported that over $1100.00 has already accrued to the Division from the new edition of "Modern Electroplating." Several possible ways of using such funds were discussed by the members present, and the Executive Committee was requested to send a list of these possibilities to the entire membership to determine its preference.

Chairman Holt also announced the appointment of F. A. Lowenheim to head a committee on the third edition of "Modern Electroplating." At present, the committee will be essentially a clearing house for errors in the second edition. Any errors, or ideas concerning future editions, should be communicated to Dr. Lowenheim at the Metal & Thermit Corporation, P.O. Box 471, Rahway, N. J.

The possibility of affiliation with the International Council on Electrodeposition was discussed. This matter will be taken up with the Board of Directors.

For future meetings, the Executive Committee was requested to consider the publication of a booklet of extended abstracts and to reconsider the use of tape or other recordings of discussions of technical papers.

R. A. Woofter, Nominating Committee Chairman, submitted the following slate of officers:

*Chairman*—Cloyd A. Snavely
*Vice-Chairman*—Sidney Barnartt
*Secretary-Treasurer*—Abner Brenner
*Member-at-Large of the Executive Committee*—M. L. Holt (replacing A. Brenner)

There were no nominations from the floor. It was moved, seconded, and carried that the nominations be closed and that the Secretary cast a unanimous ballot for the above nominees. These officers will hold office for the next two years.

SIDNEY BARNARTT,
*Secretary-Treasurer, 1952–54*

## Luminescence Symposium, May 1955

The annual Luminescence Symposium of the Electronics Division of The Electrochemical Society will be held during the week of May 2, 1955, at the 107th meeting of the Society in Cincinnati, Ohio.

Detailed plans for the Symposium have not been set and, in fact, cannot be until titles and abstracts of papers have been received by H. Bandes, Vice-Chairman (Luminescence Group), Electronics Division, Sylvania Electric Products Inc., Bayside, N. Y.

A 75-word abstract, to be printed in the general program for the meeting, will be required by *January 15, 1955*. In addition, an "expanded abstract" of about 1000 words, along with curves, data, etc., will be due not later than *February 1, 1955*. This latter abstract will be "printed, not published" in the booklet of "Enlarged Abstracts of Papers Presented by the Electronics Division" which will be available both from the Secretary of the Division, and at the meeting, at cost.

The work of your Symposium Chairman will be greatly facilitated by early notification of your intention to present a paper and by early receipt both of short and expanded abstracts.

Present plans indicate that there will be at least a two-day Symposium with one half day reserved for a Round-Table discussion and the remaining day and a half to be spent in separate, but not concurrent, sessions devoted to: (*a*) basic principles and phenomena, and (*b*) specific phosphor chemistry, structure, and behavior.

Dr. Ferd E. Williams, Research Laboratories, General Electric Company, will deliver the keynote talk and will act as Chairman of the basic principles session(s).

Following past practice, 20 to 30 minutes (including discussion) will be allotted each paper.

Following the plans of the Semiconductor Symposium of the Spring 1955 meeting, an attempt will be made to provide for 10-minute "late news" presentations. A deadline date of April 8, 1955, will allow for publicizing these "late news" items at least by mail to the members of the Division.

The Phosphor Screen Application Group, which was incorporated into the Luminescence Group in May, is organizing its own Symposium under the chairmanship of Dr. C. Dichter, General Electric Company, Syracuse, N. Y. The scope of the Group has been enhanced by deletion of "Screen" from its name.

H. BANDES, *Vice-Chairman*
(*Luminescence Group*)

## Semiconductor Symposium Planned for Cincinnati

The Semiconductor Group of the Electronics Division is making plans, to hold the third annual Semiconductor Symposium during the Cincinnati Meeting, May 1 to 5, 1955.

At present, plans are to divide the sessions as follows: two half-day sessions on semiconducting materials—elemental, alloys, and compounds; one half-day session on surface controlled phenomena; and one half-day session on chemical process technology.

In order to have a balanced agenda, it will be desirable to have a review paper of the status of each field, half-hour presentations of new information which can be scheduled by midwinter 1954, and a number of ten-minute presentations of the "late news" type.

Anyone wishing to present a paper at this symposium should have contacted F. J. Biondi, Bell Telephone Laboratories, Murray Hill, N. J., by December 1, signifying interest in participating and title of proposed papers.

*No later than January 14, 1955,* submit a 75-word abstract for inclusion in the program booklet. *No later than February 1, 1955,* submit a second "extended abstract" of about 1000 words, including brief pertinent data, curves, and illustrations. This extended abstract is "printed, but not published" in a booklet "Enlarged Abstracts of Papers Presented by the Electronics Division" and will be sold at the Cincinnati Meeting.

### Electro-Organic Division

At its regular division meeting held during the Boston Convention, the Electro-Organic Division elected officers for the 1954–1956 term. They are as follows:

*Chairman*—H. M. Scholberg
*Vice-Chairman*—Stanley Wawzonek
*Secretary-Treasurer*—G. W. Thiessen

The Division will hold its next biennial symposium in Pittsburgh in the fall of 1955. Correspondence concerning the symposium may be directed to the new Secretary-Treasurer.

N. M. WINSLOW

### Symposium Planned by Metallurgy Section of the E & M Division

The Electrothermics and Metallurgy Division is scheduling a Symposium on "Electrochemical Techniques in Metallurgical Research" for the Spring Meeting of The Electrochemical Society to be held in Cincinnati, Ohio, May 1–5, 1955.

The scope of the Symposium will include: Metallography, Thermodynamics, Electroanalysis, Preparation of High Purity Metals, Atom Movements, and Electromachining.

Contributions for this Symposium are invited from all interested persons. It is desired that papers be contributions of original research and not merely reviews of a portion of the subject field.

Abstracts (not to exceed 75 words in length) and correspondence should be submitted *not later than January 3, 1955,* to the Chairman of this Symposium, Dr. J. H. Westbrook, General Electric Research Laboratory, The Knolls, Schenectady, N. Y.

* * *

## SECTION NEWS

### New Council of Local Sections

Of special interest to Local Sections of the Society was the activation at the Boston Meeting of the new Council of Local Sections, instituted by the new Constitution as successor, with increased powers and potentialities, to the former Local Section Advisory Committee.

This unit is the result of long-continued activity on the part of members of the more active local groups who felt that regional interests were not adequately represented either by the Divisions or by the former Committee.

Under the new plan, the two Councilors elected by each Section are expected to be active members of their executive boards, fully informed of local plans and problems, and accepting the responsibility of representation of their groups at national meetings. To encourage the formation of additional local sections, provision is also made for temporary membership on the Council of Councilors-at-large from the localities of potential new sections.

The Council will be represented by two members of the National Board of Directors, one elected each year for a two-year term. Formerly the Chairman of the LSAC was automatically a member of the Board and was the only such representative of the group.

Officers of the Council elected at the Boston meeting are: F. A. Lowenheim, Chairman; F. W. Koerker, Vice-Chairman; L. O. Case, Secretary. F. A. Lowenheim and F. W. Koerker were elected Directors of the Society. The organization thus effected is for the one-half-year period until the spring meeting when permanent organization will be completed as provided in the Bylaws.

Opportunities provided by the new Council for the performance of useful services to the Local Sections can of course be realized only if on the one hand the Sections make use of the possibilities afforded and if on the other the Councilors accept their important responsibilities.

Matters of special import discussed at the meeting were: (*a*) the financing of national meetings and (*b*) publicity for Society activities.

To deal with the first problem, a committee of the Council was appointed, consisting of C. A. Hampel of Chicago and L. E. Pucher of Cleveland to act with a corresponding group from the Ways and Means Committee (M. J. Udy and F. A. Lowenheim) in recommending procedures for the financial conduct of future national meetings in a manner to serve the interests of both the Local Sections and the Society.

Extended discussion of the problem of securing desirable publicity for Society aims and activities brought out the view that, since many features of such publicity are best handled at the local level, it should be one of the primary responsibilities of the Council to promote activity of the Local Sections in this direction. Under the leadership of an active director of publicity in each Section, suitable publicity should provide for: (*a*) adequate notice to members and to interested nonmembers concerning future national and local meetings; (*b*) information concerning business and employment opportunities in electrochemistry; (*c*) encouragement of prospective students to consider the advantages of training in the field; (*d*) availability to the general public of information concerning the importance of electrochemical science and industry.

### Cleveland Section

Need for proper understanding of the corrosion properties and limitations of light metals and their alloys was stressed by Frederick W. Fink, Battelle Memorial Institute, at the October 12 dinner meeting of the Cleveland Section. Use of improper alloys or use of the materials without evaluation of environment or electrochemical factors has frequently resulted in failure and a consequent underrating of these important products. Mr. Fink reviewed the rapid growth in production during recent years of aluminum, magnesium, and titanium, in particular, and the purity requirements in certain types of application. Among the more recently developed items on which he reported briefly were magnesium-lithium alloys and aluminized steel.

Activities of the Coroner's office and particularly the chemical problems involved in investigating suicides and accidental deaths were interestingly discussed at the dinner meeting by Dr. Irving Sunshine, a member of the Cuyahoga County Coroner's staff. Carbon monoxide was reported to be the major cause of death by chemicals, with barbiturates a close second. With the exception of industrial accidents, alcohol was implicated in nearly half of all accidental deaths.

During the Section business meeting, the Boston Convention was briefly reviewed, including a report of the presentation of the Acheson Award to George W. Heise, who has long been an active member of the Cleveland Section.

K. S. WILLSON, *Secretary*

## India Section

The India Section's first technical meeting for 1954 was held on September 24 at the Indian Institute of Science, Bangalore, with Professor M. S. Thacker, Chairman of the Section, in the Chair.

Professor H. L. Walker, Visiting Professor, Indian Institute of Science, Bangalore, and formerly Head of the Department of Mining and Metallurgy, University of Illinois, delivered a lecture on "The Present Status and the Projected Future of Titanium."

The speaker said that titanium has a tremendous future as a material of construction. It alloys with a variety of metals and the alloys are superior to magnesium and aluminum alloys as a light material of construction. Outlining the methods of production of this metal, he opined that the electrolysis of the fused chloride in combination with sodium and calcium chloride had a great future. The electrolysis has been tried to a small extent in Japan, but this method of production is still under investigation. Dealing with the casting of titanium, Professor Walker explained the need to exclude oxygen and nitrogen while casting. In spite of the high cost of the metal, the alloys are being used in specialized military equipment.

With a vote of thanks to the speaker, the meeting came to a close.

S. KRISHNAMURTHY, *Secretary-Treasurer*

## New York Metropolitan Section

The first meeting of the season was held by the Metropolitan Section on September 22. Dr. Ivor E. Campbell of Battelle Memorial Institute was the guest speaker and his subject was "Current Trends in High Temperature Materials." He stated that, were it not for the atomic and hydrogen bombs, the period since the second World War might well go down in technological history as the high temperature era. The gas turbine, the ram-jet engine, rocket propelled missiles and aircraft, and nuclear reactors have presented demands for materials to withstand both high temperatures and corrosive environments. While great improvements may be made in the superalloys, the temperature limits of purely metallic materials are below the desired limits. This has lead to much work in the development of combinations of metallic and ceramic materials to combine the high temperature strength of ceramics and the low temperature ductility of metals. None of the combinations tried has been entirely satisfactory. Because of the great interest in the field of superrefractories, the Electrothermics and Metallurgy Division has prepared a monograph on the subject which has just been placed in the hands of the publisher.

Some of the refractories which are of particular interest are the borides, nitrides, silicides, and sulfides. The borides of the high melting metals of the fourth, fifth, and sixth periodic groups have high melting points, low vapor pressures, low electrical resistivity, high hardness, and high stability; which makes these of potential value in certain specialized high temperature applications. They do not, however, have outstanding oxidation resistance and the rate of attack becomes appreciable above 1300° to 1500°C. The borides appear to be slightly more stable than the carbides at high temperatures. Boride powders which may be consolidated by hot-pressing techniques may be formed by carbo- or alumino-thermic reduction of mixed oxides, or by direct synthesis of metal and boron powders.

The silicides of the refractory metal, while not nearly as refractory as the borides, have attracted considerable attention because of their good oxidation resistance at very high temperatures. They have high thermal and electrical conductivity and are corrosion resistant at room temperature but become reactive toward many chemicals at high temperatures. At room temperature they are brittle, but at above red heat have limited ductility. Techniques for forming silicides are quite similar to those used to form borides.

The nitrides have high melting points, are very hard, although not as hard as borides, and have a metallic luster. The nitrides of the Group VI elements have high dissociation pressures at elevated temperatures. The nitrides of Group IV and Group V elements are of most interest. They may be prepared by the reaction of nitrogen or ammonia with the metal or a metal oxide-carbon mixture. Attempts have been made to use titanium and zirconium nitride crucibles for melting and it was found that cerium and iron could be melted in either.

Brewer and his co-workers have found that some of the refractory sulfides, such as high purity cerium sulfide, gave exceptionally good results when used as crucibles for melting of high purity metals. Since sulfides are readily oxidized they cannot be used at elevated temperatures in air, but might be used in inert atmospheres or vacuum. They may be prepared by direct combination of the elements, but are usually more readily prepared by reacting the metal chloride with hydrogen sulfide or carbon disulfide.

Most of these refractory materials are not obtained in commercial quantities and are quite expensive. None has found extensive use as yet, but it appears that the silicide of molybdenum as a protective coating for pure molybdenum or as a resistance heating element might be the first of these materials to find practical application.

K. B. MCCAIN, *Secretary-Treasurer*

## San Francisco Section

On September 22 the San Francisco Section held a meeting at the Faculty Club of the University of California. Guest speaker was Dr. Charles d'A. Hunt of the Tennessee Metallurgical Corporation and Research Department of the Stauffer Chemical Company. His topic was "Some Aspects of High Vacuum Techniques in Metallurgy of Rare Metals."

Dr. Hunt's talk was concerned with both laboratory-scale and production-scale experience with high vacuum and inert atmospheres in modern metallurgical processes dealing with the metals titanium and zirconium. These are both transition series elements characterized by a high melting point and high reactivity to the major components of air. Where a high gettering efficiency exists, as it does for these elements at high temperatures, the problem of prevention of contamination almost becomes statistical in nature. In this case, the best freedom from contamination exists under minimum leakage conditions and with a physical situation such that the maximum possible fraction of the system walls become the entry into pumps.

Insofar as the reactive gases are permanent gases at the operating temperature, the statistical nature of the process favors increased opportunity for product purity as the pump opening area becomes a greater portion of

the total system walls. In the region of the low pressure, where mean free paths are large in relation to the system, pumping impedance is governed by geometry effects which are not significant at higher pressures. In this low pressure range, it becomes possible to utilize the direction and velocity effects to reduce the level of contamination below that formerly attainable. In effect, this new approach requires use of much higher pumping speeds than were previously thought necessary.

The combination of high pumping speeds with multistage pumped seals creates conditions favorable to the production of metals of higher purity than was economical in the past. The consideration of high pumping speed and multistage pumped seals also applies directly to the processes where protective atmospheres are utilized. Good and complete removal of the initial contaminating air in the system and use of pumped seals is advisable for systems operated under inert atmospheres. This is because diffusion, and the generally low rate of circulation and purification of the protective atmosphere, furnishes as much or more opportunity for contamination of the product than would occur under high vacuum conditions.

The talk was illustrated with examples relating to various refining methods for titanium sponge, including some discussion of one process that failed to recognize the rate-controlling limitations introduced by internal diffusion processes.

Following the talk, there was an interesting discussion period on questions of vacuum metallizing and refining of the rare metals.

The following are the newly-elected officers of the Section:

*Chairman*—Charles Tobias
*Vice-Chairman*—Morris Feinleib
*Secretary-Treasurer*—H. F. Myers
*Representatives on the Council of Local Sections*—R. F. Bechtold and S. H. Dreisbach

R. F. Bechtold has been appointed Chairman of the 1956 San Francisco Convention Committee.

H. F. Myers, *Secretary-Treasurer*

## PERSONALS

Walter H. Prine has been appointed head of the Electroplating-Chemical-Catalyst Section of the Nickel Sales Department of International Nickel Company, Inc., New York City. He will be handling commercial relations with distributors and users of nickel for electroplating, for chemical manufacturers and for catalysts. Mr. Prine joined International Nickel in 1945 as a member of the Plating Section of the Sales Department, working in liaison between the company's research laboratory and the plating field in the development of new uses and the extension of prevailing uses of nickel in this field.

Robert L. Crone, research engineer with the Hughes Aircraft Company, has been transferred from Culver City, Calif., to the company's Tucson, Ariz., plant.

Frank Nabers, formerly assistant general manager of the Great Lakes Carbon Corporation's Electrode Division, is now with the Wilson Oil Corporation, Wilson, N. C. Mr. Nabers is president and owner of the firm which deals in Shell Oil Company products.

Robert L. Womer has been appointed vice-president in charge of research and development for Speer Carbon Company, St. Marys, Pa. Dr. Womer formerly was assistant for divisional research at Olin Mathieson Chemical Corporation.

Karl F. Hager has accepted a position as assistant to the general manager, Plastics Division, Curtiss-Wright Corporation, Carlstadt, N. J. Previously, Dr. Hager was chief of the Chemistry Laboratory, Guided Missile Development Division, Redstone Arsenal, Huntsville, Ala.

Hyman Chessin has left the University of Arkansas, Fayetteville, Ark., to join the staff of the Van der Horst Corporation, Olean, N. Y., as assistant director of research.

James H. Moore has been appointed by Vacuum Metals Corporation as general manager with general offices located in Syracuse, N. Y. Vacuum Metals Corporation, jointly owned by Crucible Steel Company of America and National Research Corporation, was the country's first commercial producer of vacuum melted metals and alloys. In the announcement of Mr. Moore's appointment it was stated that all vacuum melting production facilities formerly operated by National Research and Crucible Steel in Cambridge, Mass., are now being moved to Syracuse. Upon completion of this move all management, production, and sales activities will be centralized at Syracuse.

Basil G. Apostle is now at National Aniline Division, Allied Chemical & Dye Corporation, Chesterfield Works, Hopewell, Va., as chemist in research and development. He was previously at the company's Buffalo plant.

Robert V. Jelinek recently resigned from the faculty of Columbia University in order to accept an appointment as assistant professor of chemical engineering at Syracuse University, Syracuse, N. Y.

R. L. Glover has been transferred from National Carbon Company, Toronto, where he was factory manager, to the National Carbon Research Laboratories, Cleveland, Ohio, as assistant director of research.

## NEW MEMBERS

In October 1954 the following were approved for membership in The Electrochemical Society by the Membership Qualifications Committee:

### Active Members

Albert Ausderau, The Electrona Battery Ltd., Mail add: 27, Rue du Stand, Peseux/Neuchâtel, Switzerland (Battery)

Theodore Richard Beck, Kaiser Aluminum & Chemical Corp., Mail add: 20875 Fargo Dr., Cupertino, Calif. (Industrial Electrolytic, Theoretical Electrochemistry)

Robert Crocker Brasted, Dept. of Chemistry, University of Minnesota, Minneapolis 14, Minn. (Battery)

H. McCrae Brown, National Carbon Co., 805 Davenport Rd., Toronto, Ontario, Canada (Battery)

(*Continued on page 303C*)

# Officers of Local Sections of the Society

*Chicago*

B. F. Freeberg, Chairman
E. L. Koehler, Vice-Chairman
R. D. Misch, Treasurer
J. E. Draley, Secretary
Argonne National Laboratory
P. O. Box 299
Lemont, Ill.

Representatives on Council of Local Sections:
Howard Francis (1 year)
Clifford Hampel (2 years)

*Cleveland*

Ernest B. Yeager, Chairman
W. H. Stoll, Vice-Chairman
Merle E. Sibert, Treasurer
Karl S. Willson, Secretary
General Dry Batteries Co.
13000 Athens Ave.
Cleveland, Ohio

Representatives on Council of Local Sections:
L. E. Pucher (1 year)
N. C. Cahoon (2 years)

*Detroit*

Wright Wilson, Chairman
Andrew Liger, 1st Vice-Chairman
Gerald V. Kingsley, 2nd Vice-Chairman
Manny Shaw, Sec.-Treas.
19411 Winthrop Ave.
Detroit, Mich.

*Midland*

F. N. Alquist, Chairman
M. P. Neipert, Vice-Chairman
P. R. Juckniess, Sec.-Treas.
The Dow Chemical Company
Midland, Mich.

Representatives on Council of Local Sections:
F. W. Koerker (1 year)
H. A. Robinson (2 years)

*New York Metropolitan*

M. F. Quaely, Chairman
M. B. Diggin, Vice-Chairman
Kenneth B. McCain, Sec.-Treas.
Wilbur B. Driver Company
150 Riverside Ave.
Newark, N. J.

Representatives on Council of Local Sections:
A. C. Loonam (1 year)
Herbert Bandes (2 years)

*Niagara Falls*

G. M. Butler, Chairman
John E. Currey, Vice-Chairman
James Woodburn, Jr., Sec.-Treas.
Great Lakes Carbon Corp.
Niagara Falls, N. Y.

*Pacific Northwest*

Joseph B. Heitman, Chairman
G. H. Kissin, Vice-Chairman
Kenneth L. Sanborn, Sec.-Treas.
General Electric Company
2005 Pullen
Richland, Wash.

*Philadelphia*

J. Fred Hazel, Chairman
Edgar L. Eckfeldt, Vice-Chairman
G. Franklin Temple, Treasurer
George W. Bodamer, Secretary
Rohm & Haas Company
Philadelphia, Pa.

Representatives on Council of Local Sections:
John F. Gall (1 year)
Edgar L. Eckfeldt (2 years)

*Pittsburgh*

M. T. Simnad, Chairman
R. D. Williams, Vice-Chairman
Robert A. Woofter, Sec.-Treas.
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

*Washington-Baltimore*

Fielding Ogburn, Chairman
D. T. Ferrell, Jr., Vice-Chairman
Jeanne B. Burbank, Sec.-Treas.
Naval Research Laboratory
Washington, D. C.

Representatives on Council of Local Sections:
J. C. White (1 year)
D. T. Ferrell, Jr. (2 years)

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## RECENT PATENTS

Selected by Fred. W. Dodson, Chairman of the Patent Committee, from the Official Gazette.

September 7, 1954

Forgue, S. V., 2,688,564, Method of Forming Cadmium Sulfide Photoconductive Cells

Warshaw, A., 2,688,572, Liquid Purification by Electrodialysis and Ion Exchange

**Notice to Members**

By now you have received your official voting ballot from Society Headquarters. If you have not already done so, please return the ballot by *December 15* so that your vote may be included in the final election count.

Reed, R. B., and Woods, E. M., 2,688,574, Method of Making Bimetal Contact Tape

Skeeters, M. J., and Cooper, R. S., 2,688,592, Photochemical Process For Preparing Carbon Tetrachloride

Nelson, O. G., 2,688,593, Apparatus for Guiding Filaments

Oosterman, J., 2,688,594, Mercury Cell

Travnicek, M. M. F. L., Ouweltjes, J. L., and Kroger, F. A., 2,688,600, Magnesium Arsenate Phosphor Activated by Manganese

McIllvaine, O. T., 2,688,648, Electron-Generating Element for Pilot Flame Safety Controls

Bjorksten, J., 2,688,649, Printed Battery and Method for Making

Knochel, W. J., and Weingartner, W., 2,688,709, X-Ray Anode and Method of Making Same by Electric Welding

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Botham, G. H., Lancaster, J. F., and Dawson, D. W. O., 2,689,177, Corrosion-Resistant Alloy Steels

Hushley, W. J., 2,689,188, Fluorescent Screen of a Phosphor in Glass and Method for Producing Same

Hushley, W. J., 2,689,189, X-Ray Fluorescent Screen

Hushley, W. J., 2,689,190, Fluorescent Screen and Method for Forming Same

Soby, W., 2,689,214, Manufacture of Metal Articles by Electrodeposition

Bart, S. G., 2,689,215, Method and Apparatus for Plating Pipe

Nevers, R. P., and Palmer, E. W., 2,689,216, Electrodeposition of Copper

Cotton, W. J., 2,689,217, Production of Chlorine Oxides by Electric Discharge

Godshalk, J. B., and Medlar, L. A., 2,689,322, Method and Apparatus for Treating Batteries

Staunton, J. J. J., 2,689,330, Differential Dropping Mercury Electrode Instrument and Method

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Gray, A. N., 2,689,399, Plated Article and Method of Making It

Kollsman, P., 2,689,826, Electrodialyt... Apparatus

Sadowsky, M., and Groner, M. G..., 2,689,830, Burn-Resistant Lumine... cent Product and Method of Maki... the Same

Lehovec, K., 2,689,876, Solid Io... Electrolyte Battery

Briggs, L. G., 2,689,877, Flat Dry Cel...

Godshalk, J. B., 2,689,939, Battery Testing Apparatus

Zechel, R. F., 2,689,946, Battery Con... nector

## BOOK REVIEW

IN TRANSPORT ACROSS MEMBRANES. Hans T. Clarke, Editor, David Nachmansohn, Associate Editor. Published by Academic Press, Inc., New York, 1954. 298 + xi pages, $7.50.

This volume contains a collection of papers based upon a Symposium on The Role of Proteins in Ion Transport Across Membranes, sponsored by the National Science Foundation and held at the College of Physicians and Surgeons of Columbia University on October 2 and 3, 1953, in honor of the 25th Anniversary of the Columbia-Presbyterian Medical Center. The purpose of the Symposium was to bring together a group of physicochemically minded biologists working on ion transport with a group of physical chemists interested in the problem for the exchange of information and ideas. In addition to the eight papers of the Symposium, six invited articles on related subjects are also included.

The topics covered range from the highly theoretical discussions of Terrell Hill on protein solutions, Kirkwood and Scatchard on ion transport, Eyring on membrane permeability, and Debye on sedimentation, to specific experimental work such as Edsall on interactions of proteins and ions, and Sollner and coworkers on membrane studies. Excellent reviews by A. F. Huxley on mechanism of nerve conduction, and Nachmansohn and Wilson on the role of acetylcholine in bioelectric potentials and membrane permeability are presented.

Bibliographies are included with each paper, and a complete subject and author index at the end greatly increase the usefulness of this book. Workers in the field will find it invaluable as a reference, while newcomers to the field should find it helpful as a review of past work.

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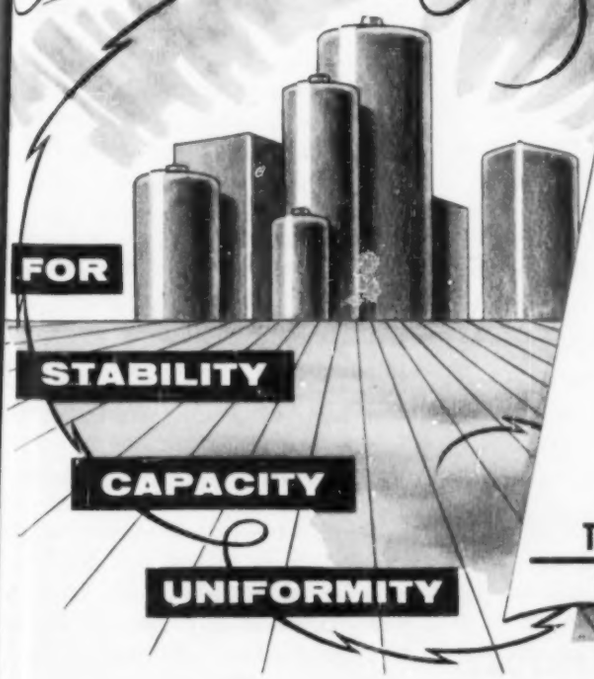

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## LITERATURE FROM INDUSTRY

"CONSOLIDATED SYSTEMS ENGINEERING." Custom engineering of electronic instrumentation tailored to specific industrial, scientific, and military needs is the subject of a colorful 16-page brochure recently announced. The publication describes the role of the veteran instrument company's newly formed Systems Division, established to meet growing industrial and scientific demand for entire "systems" of automatic data-processing and control equipment. Case histories of typical instrumentation systems, applications, biophiles on key personnel, description of service facilities and methods of planning used to solve customer problems are features highlighted. Consolidated Engineering Corp. P-254

PLUG VALVE ACTUATOR. Recently released 2-color, 8-page illustrated bulletin fully describes new line of plug valve actuators. This line is available for the remote control of all types and sizes of wrench-operated valves from 1 in. up to 8 in. Illust with photographs of typical ins tions and detailed line drawings, bulletin gives complete engine data as well as information on how plug valve actuators are used. included is helpful information simplifies ordering procedure. Pa Manufacturing Corp. P

FISHER GRAM-ATIC BALANCES. 8- fully illustrated bulletin gives theory and operation of Amer first single-pan balances. Included section on the *Micro* Gram-atic Bal as well, a single-pan constant-sensiti balance with an accuracy of ±0. mg, and requiring 1/3 to 1/4 the tim conventional micro balances. included is a description of a spe purpose single-pan balance for weigh large samples of paper, sheets of d paint, film, cloth, and other mater that will not fit inside regular weigh compartments. Fisher Scientific Co. P-2

TITANIUM FOIL. Titanium foil rol to very close tolerances and t gauges is completely described in new technical data bulletin. The da sheet describes commercially pu titanium foil now being produced Sendzimir mill equipment. It includ mill limits, tolerance chart, composition of commercially pure grade titaniu foil, mechanical, and electrical prope ties. Also included are data on weldin brazing, annealing, and forming titanium foil, and a list of suggeste applications. American Silver Co Inc. P-2

HIGH-SPEED FRAMING CAMERAS. Tw models of Beckman & Whitley hig speed framing cameras are described i a new 4-page folder. Designed for en gineering and research studies of com bustion, corona-discharge, explosion plastic- and elastic-deformation, an shock-wave phenomena, the two cam eras are capable, respectively, of 1. million and 2.4 million frames per sec ond, total number of frames in each case being 25. Besides illustrating th camera and control console in operat ing position, the literature include pictures taken by the camera itself o such subjects as shock waves travelin through Lucite, progressive stages in a cylinder of detonated high explosive and progress of disintegration through the glass block of a Beckman & Whit ley blast shutter. Beckman & Whitley, Inc. P-25


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TUBELESS D-C SUPPLY. A tubeless, regulated d-c supply, using magnetic amplifier principles, is now available. The unit is designated as Nobatron Model MA640. Its highly advanced tubeless circuit makes it very desirable where accuracy and high capacity must be combined with utmost reliability. Specifications include: input—105–125 VAC, single phase, 60 cycle; output—4.5–7.7 VDC, adjustable; load range—0–40 amp; ripple—1% maximum; regulation accuracy—±1.0% for any combination of line and load conditions. Sorensen & Co., Inc. N-130

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## MANUSCRIPTS AND ABSTRACTS FOR SPRING MEETING

Manuscripts are now being received for the Spring Meeting of the Society, to be held at the Sheraton-Gibson Hotel in Cincinnati, May 1, 2, 3, 4, and 5, 1955. Subjects to be covered at the technical sessions probably will be Electric Insulation, Electronics, Electrothermics and Metallurgy, Industrial Electrolytics, and Theoretical Electrochemistry.

To be considered for this meeting, triplicate copies of manuscripts or abstracts (not to exceed 75 words in length) must be received at Society headquarters, 216 West 102nd Street, New York 25, N. Y., *not later than January 15, 1955.*

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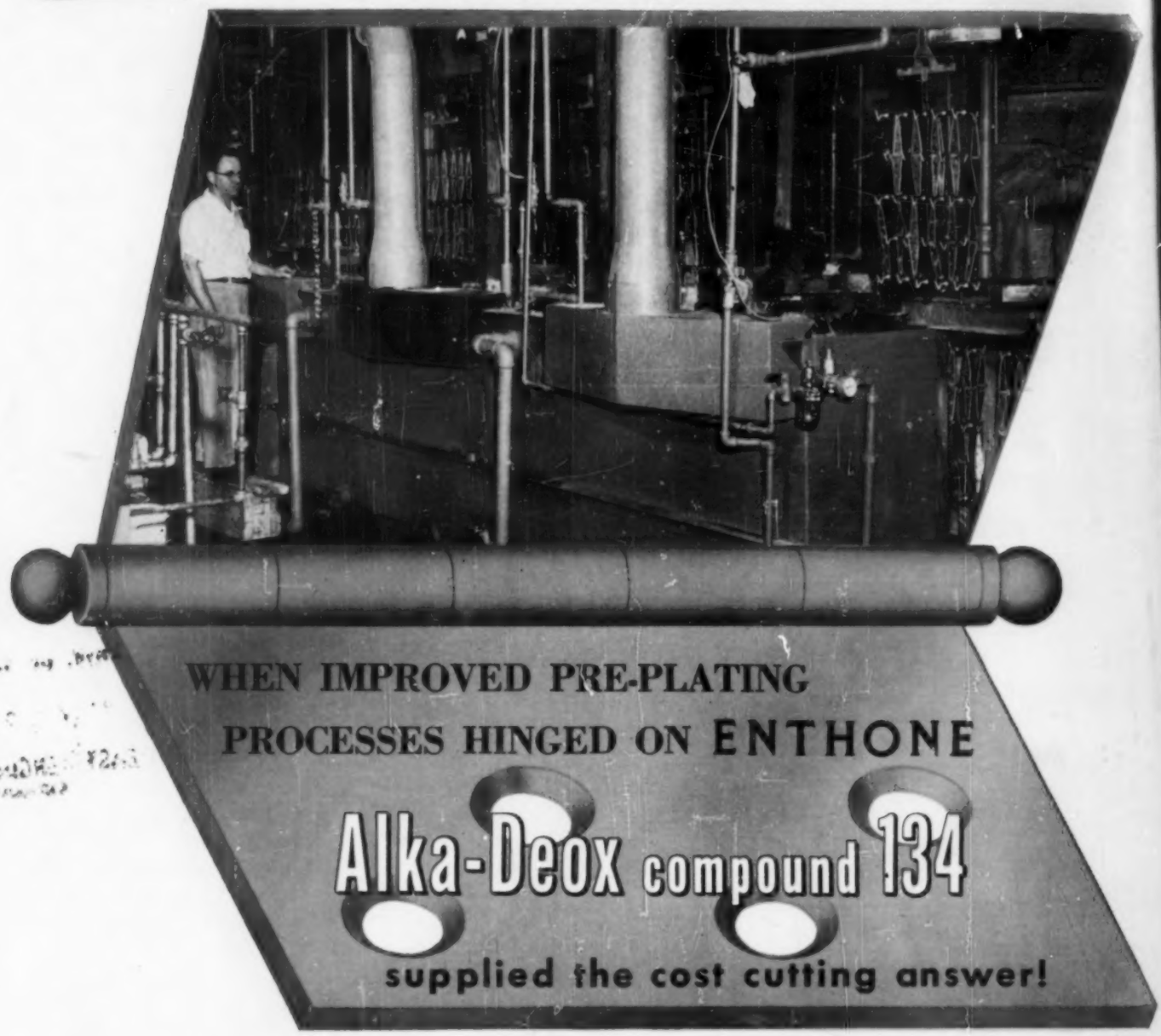

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